THEOPHRASTUS OF ERESOS AS AN ECONOMIC ENTOMOLOGIST

By Melville H. Hatch
University of Washington, Seattle, Washington

Science is organized knowledge. This is platitudinous, but it is frequently forgotten by the science historian, who drapes the most isolated and inconsequential observations as science. Thus, multitudes of persons at every stage of human culture have noted some of the facts of insect injury, but it is only when these observations become organized that we can speak of economic entomology. It is interesting, therefore, to note the occurrence of such organized observations in the scientific literature of ancient Greece.

Theophrastus was born at Eresos on the island of Lesbos between 373 and 368 B.C. There is ancient authority (Diog. L. v. 36) for the supposition that he joined Aristotle at Athens before the death of Plato in 346/7, but Jaeger (Aristotle, Eng. Trans. 1934, pp. 115–116) suggests that he did not meet the Stagerite until he opened a school of philosophy at Assos (348–345) on the coast of Asia Minor, only a few miles distant from Lesbos. Here, at any rate, and in nearby Mitylene, he was associated with Aristotle during those momentous years when the science of zoology was taking form in Aristotle's mind. He may well have been the "research assistant" in some of those studies and have shared the fate of many another research assistant—that of doing much of the work and receiving none of the credit.

Thenceforth Theophrastus was associated with Aristotle during the rest of Aristotle's life, at first in Macedonia at the court of King Philip, and then at Athens; and after Aristotle's death in 322, he became head of his school, surviving until the 123rd Olympiad (288–285). Personally he was of a retiring, studious disposition, entirely devoted to his philosophical and scientific studies; and he must have been much relieved when the turn of events made it unnecessary for him to marry Aristotle's daughter, Pythias, as Aristotle's will directed. In fact, he never married,

and his philosophical justification of celibacy is contained in a fragment that is still preserved (Zeller, *Aristotle* ii, p. 405).

With the passage of the centuries, Theophrastus became known principally as the author of a work, *Ethical Characters*—brief, vigorous and trenchant delineations of moral types,—and as the "father of botany." This was the result, in great measure, of the unkind fashion in which the years treated Theophrastus' literary legacy. For, in reality, he seems to have carried on studies along the same broad lines as his master, Aristotle, seeking, principally, to polish up and fill out the details of the latter's system. Indeed, the extant treatises on plants may be looked upon as an elaboration of Aristotle's account that was so successful as to completely displace the latter, which became lost after the time of Hermippus of Smyrna, about 200 B.C.[1]

The account of plants given by Theophrastus is the most complete botanical work of ancient or mediaeval time. Not only does he mention 550 kinds of plants, but, in the *Enquiry into Plants,* he treats them from many different points of view, so that mention of the insect enemies of certain plants is introduced as integral portions of the larger work. The references are not extensive, but they represent the effort at organizing observations that is the basis of all scientific work.

Thus, in Book VII, chapter V, on "pot-herbs," he says:

"As for pests,—radish is attacked by fleas,[2] cabbage by caterpillars and grubs, while in lettuce, leek, and many other herbs occur 'leek-cutters.' These are destroyed by collecting green fodder, or when they have been caught somewhere in a mass of dung, the pest being fond of dung emerges, and having entered the heap, remains dormant there; wherefore it is then easy to catch, which otherwise it is not. To protect radishes against fleas it is of use to sow vetch among the crop; to prevent the fleas from being engendered they say that there is no specific."

And again, book VIII, chapter X:

"Wheat is . . . destroyed by grubs; sometimes they eat the

[1] See Zeller, *Aristotle* i, pp. 93–94.

[2] Hort (p. 95) translates ψυλλα, "spider," and Bodenheimer (p. 72), "Erd-Flöhe," but there appears no good reason for departing from a literal rendering, especially since Bodenheimer (l.c.) suggests that the insect in question is *Phyllotreta cruciferarum* Goeze, one of the "flea-beetles."

roots, as soon as they appear, sometimes they do their work when by reason of drought the ear cannot be formed; for at such times the grub is engendered, and eats the haulm as it is becoming unrolled; it eats right up to the ear and then, having consumed it, perishes. And, if it has entirely eaten it, the wheat itself perishes; if however it has only eaten one side of the haulm and the plant has succeeded in forming the ear, half the ear withers away, but the other half remains sound. However it is not everywhere that the wheat is so affected; for instance this does not occur in Thessaly, but only in certain regions, as in Libya and at Lelanton in Euboea.

"Grubs also occur in *okhros, lathyros* and peas, whenever these crops get too much rain and then hot weather supervenes; and caterpillars occur in chick-peas under the same conditions. All these pests perish, when they have exhausted their food, whether the fruit in which they occur be green or dry, just as wood-worms do and the grubs found in beans and other plants, as was said of the pests found in growing trees, and in felled timber. But the creature called 'horned-worm' is an exception. Now in regard to all these pests the position makes a great difference, as might be expected. For the climate, it need hardly be said, makes a difference according as it is hot or cold, moist or dry; and it was the climate which gave rise to these pests; wherefore they are not always found even in places in which they ordinarily occur."

Later on (VIII. xi) the engendering of grubs (pea-weevils) by seeds as they decay is noted, for Theophrastus, as we have seen, was perfectly ready to accept abiogenesis as a fact, whenever the observations seemed to point that way.

Book IV, chapter XIV is a six or seven page discussion of the diseases of trees; worms are mentioned several times:

"Of the worms found in fig-trees some have their origin in the tree, some are produced in it by the creature called the 'horned-worm'; but they all turn into the 'horned-worm'; and they make a shrill noise. . . . In Miletus the vines at the time of flowering are eaten by caterpillars, some of which devour the flowers, others, a different kind, the leaves; and they strip the tree; these appear if there is a south wind and sunny weather. . . .

"There is a . . . disease incident to the olive, which is called cobweb; for this forms on the tree and destroys the fruit. . . . And the fruits of some get worm-eaten, as olive, pear, apple, medlar, pomegranate. Now the worm which infests the olive, if it appears below the skin, destroys the fruit; but if it devours the stone it is beneficial. And it is prevented from appearing under the skin if there is rain after the rising of Arcturus. Worms also occur in the fruit which ripens on the tree, and these are more harmful as affecting the yield of oil. Indeed these worms seem to be altogether rotten; wherefore they appear when there is a south wind and particularly in damp places. . . ."

Book V, chapter IV treats of wood:

"They say that the wood of the fir is more liable to be eaten by the *teredo* than that of the silver-fir; for that the latter is dry, while the fir has a sweet taste, and that this is more so, the more the wood is soaked with resin; they go on to say that all woods are eaten by the *teredo* except the olive, wild or cultivated, and that these woods escape, because of their bitter taste. Now woods which decay in sea-water are eaten by the *teredo,* those which decay on land by the *skolex* and *thrips;* for the *teredo* does not occur except in the sea. It is a creature small in size, but has a large head and teeth; the *thrips* resembles the *skolex,* and these creatures gradually bore through timber. The harm that these do is easy to remedy; for, if the wood is smeared with pitch, it does not let in water when it is dragged down into the sea; but the harm done by the *teredo* cannot be undone. Of the *skolekes* which occur in wood, some come from the decay of the wood itself, some from other *skolekes* which engender therein. For these produce their young in timber, as the worm called the 'horned-worm' does in trees, having bored and scooped out a sort of mouse-hole by turning round and round. But it avoids wood which has a strong smell or is bitter or hard, such as boxwood, since it is unable to bore through it. . . ."

Finally, the role of the *psenes* or 'gall-insects' in the caprification of figs is noted (II. viii). Insect galls are likewise referred to (III. v and vii), but there is no evidence that Theophrastus appreciated that they were the product of animal activity.

Such is the evidence, then, that Theophrastus must be reckoned among the earliest exponents of economic entomology.

I have not ventured to interrupt the quotations with attempts at the identification of the insects mentioned, nor is their recognition necessary for the purpose of the present note. But the identity of many of the species is not difficult to trace. The fleas on radish were flea-beetles; the caterpillars on cabbage were cabbage butterflies; the 'horned-worm,' a cerambycid beetle; the grubs engendered in seeds, pea-weevils; the cobweb of olive, red spider; the worm of fruits, codling-moth; the *teredo* of timber in sea-water, the ship worm. Bodenheimer in his *Geschichte der Entomologie* proposes additional identifications still.

BIBLIOGRAPHY

Bodenheimer, F. S. Materialien zur Geschichte der Entomologie bis Linne, I, 1928, pp. 70–76.

Theophrastus. Enquiry into plants (translated by Sir Arthur Hort), 2 vols. 1916 (Loeb Classical Library).

Zeller, E. Aristotle and the earlier peripatetics (translated by B. F. C. Costelloe and J. H. Muirhead), II, 1897, pp. 348–416.